Center Innovation Fund: GSFC CIF

Enhancing Sensitivity by Integrating a Custom Front End Electronics with Nanosensor Printed using 3D Printing Technique

Completed Technology Project (2016 - 2017)

Project Introduction

This project has two main objectives. The first objective is to take advantage of 3D printing techniques (developed by Professor Busnaina at Northeastern University) to print patterns of nanomaterials such as carbon nanotubes, graphene, and molybdenum disulfide to fabricate a suite of sensors with different nanomaterials and metal leads directly on a daughter board that can be wire bonded to a Printed Circuit Board (PCB). These sensors will then be tested with target gases. The second objective is to develop the Front End Electronics (FEE) to read out the sensors. Using the sensor response to target gases, the PI and team can then initiate development of algorithms for technology demonstration. This CIF will leverage previous internal research efforts, complete the FEE development, incorporate a plug-and- play interface for the nanosensors, and characterize them with gases (ammonia and hydrogen). Innovative aspects include the fabrication of nanosensors with 3D printing, and custom plug-and-play FEE and DSP techniques.

Anticipated Benefits

Improved sensors which can detect minute concentrations of gases and vapors in the ppb level are a key technology required for future Planetary Science, Heliophysics and Human Exploration missions. Current mass spectrometers have difficulty reaching the needed sensitivity, and are also rather large and require significant power. Nanosensors printed by an innovative "off-set printing" or "3D" technique, developed by Northeastern University, offer a tempting alternative. This CIF will continue development of such 3D printed nanosensors for in situ chemical sensing, and also develop the front end electronics for read out. The end product will be a prototype instrument for gas sensing. The small size, low power and high sensitivity of these sensors make them a game changing technology that can be used for a variety of space applications.

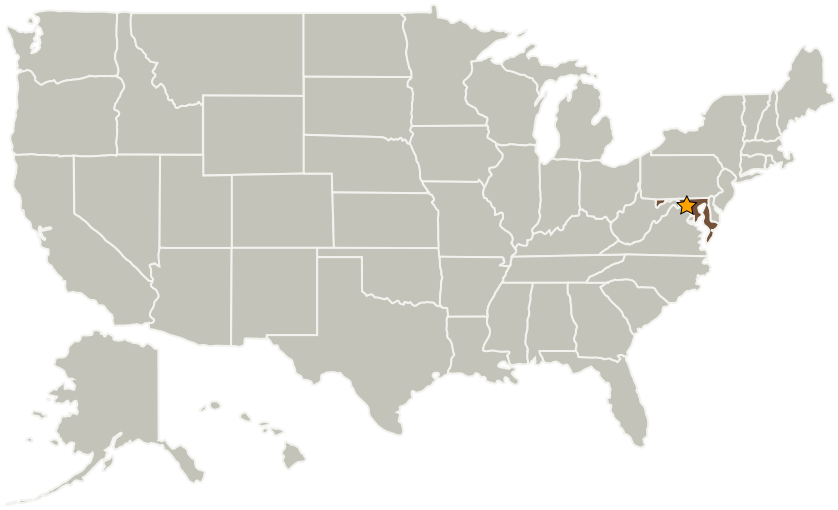
Enhancing Sensitivity by Integrating a Custom Front End Electronics with Nanosensor Printed using 3D Printing Technique

Table of Contents

Enhancing Sensitivity by Integrating a Custom Front End Electronics with Nanosensor Printed using 3D Printing Technique

Completed Technology Project (2016 - 2017)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Northeastern University(NEU)	Supporting Organization	Academia	Boston, Massachusetts

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Innovation Fund: GSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

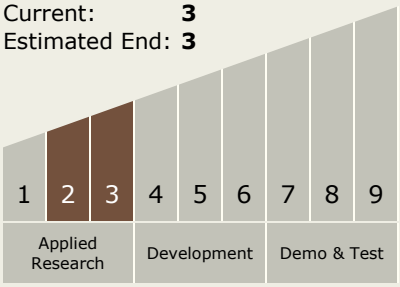
Peter M Hughes

Principal Investigator:

Mahmooda Sultana

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Enhancing Sensitivity by Integrating a Custom Front End Electronics with Nanosensor Printed using 3D Printing Technique

Completed Technology Project (2016 - 2017)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.4 Contact-less / Wearable Human Health and Performance Monitoring

Target Destinations

The Sun, Earth, Others Inside the Solar System